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Europa (52).

Mean Solar Time of Observation.		R.A. from Observation.	N.P.D. from Observation.
	h m s	h m s	° ′ ″
1861, Nov. 5	9 40 50·9	0 41 13·68	95 58 39·84
7	9 32 3·7	0 40 18·14	96 0 29·62
11	9 14 53·1	0 38 50·96	96 3 46·32
20	8 37 17·0	0 36 37·71	95 59 27·43
30	7 57 30·1	0 36 9·84	95 39 58·27

All the observations of N.P.D. have been corrected for refraction and parallax.

Occultations of Stars by the Moon.

Day of Obs.	Phenomenon.	Moon's Limb.	Mean Solar Time. h m s	Observer.
1861, Nov. 6	B.A.C. 6448 disapp. (*a*)	Dark	6 35 26·4	D.
17	33 Tauri, disapp. (*b*)	Bright	10 12 45·7	J. C.
17	33 Tauri, reapp. (*b*)	Dark	11 6 51·8	J. C.

(*a*) Clouds passing over the moon. (*b*) Somewhat unsatisfactory.
The initials D. and J. C., are those of Mr. Dunkin and Mr. Carpenter.

Phenomena of Jupiter's Satellites.

Day of Observation. 1861.	Satellite.	Phenomenon.	Mean Solar Time. h m s	Observer.
Nov. 18	IV	Occ. reapp. first cont. (*a*)	16 32 4·8	J. C.
18	IV	,, bisection (*a*)	16 45 34·2	J. C.
18	IV	,, last cont. (*a*)	16 48 33·7	J. C.
27	I	Ecl. disapp. (*b*)	14 21 49·4	D.

(*a*) The planet's image extremely bad. (*b*) The sky very hazy.
The initials as before.

Observations of Comet II., 1861, *made with the Heliometer at the Radcliffe Observatory, Oxford.* By the Rev. R. Main.

Day. 1861.	Greenwich M.T. h m s	Apparent R.A. h m s	Apparent N.P.D. ° ′ ″
June 30	11 1 47·4	6 40 13·07	43 25 11·1
	11 29 36·1	6 41 6·02	43 14 34·5
July 2	11 23 2·8	8 32 23·31	27 31 1·1
	11 30 4·3	8 32 45·14	27 29 42·9

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Day. 1861.	Greenwich M.T.	Apparent R.A.	Apparent N.P.D.
	h m s	h m s	° ′ ″
July 3	9 31 58·2	9 38 37·98	24 12 49·7
	9 47 43·2	9 39 24·94	24 11 24·8
4	11 5 17·8	10 51 13·03	23 5 24·7
	11 12 31·1	10 51 31·08	23 5 24·4
5	9 17 25·0	11 42 29·24	23 36 1·9
	9 22 47·1	11 42 39·82	23 36 3·6
	9 26 17·5	11 42 49·05	23 36 21·4
	9 33 42·3	11 43 1·49	....
6	9 47 58·0	12 25 1·27	24 53 0·9
	9 52 59·2	12 25 8·45	24 53 24·7
	9 57 8·9	12 25 15·06	24 53 38·7
8	10 27 22·0	13 18 1·07	27 56 35·3
	10 32 14·9	13 18 5·28	27 56 53·7
	10 38 51·7	13 18 10·79	27 57 25·3
	10 43 25·5	13 18 14·18	27 57 37·7
9	9 24 58·9	13 34 7·30	29 18 1·1
	9 33 26·5	13 34 12·91	29 18 39·3
	9 39 15·2	13 34 15·56	29 18 51·2
	10 5 31·0	13 34 30·55	29 20 20·9
10	10 22 28·1	13 47 35·60	30 38 46·1
	10 28 9·6	13 47 38·39	30 39 8·7
	10 33 14·2	13 47 40·79	30 39 25·5
	10 37 7·9	13 47 42·46	30 39 37·2
14	10 43 14·6	14 18 43·61	34 36 9·1
	10 48 39·7	14 18 45·39	34 36 24·7
	10 57 46·4	14 18 46·56	34 36 40·8
	11 6 3·9	14 18 49·10	34 36 58·6
	11 15 44·2	14 18 51·30	34 37 19·9
15	9 44 22·2	14 23 27·83	35 19 24·8
	9 54 15·1	14 23 29·59	35 19 31·6
	10 5 25·7	14 23 31·19	35 19 54·3
16	10 40 16·0	14 27 48·53	36 1 55·8
	10 45 23·2	14 27 49·36	36 2 7·8
	10 51 18·4	14 27 48·82	....
	10 57 2·5	14 27 50·92	36 2 20·0
	11 2 53·3	14 27 51·96	....
	11 8 22·6	14 27 52·87	....
	11 15 53·2	....	36 2 44·1
	11 21 22·3	....	36 2 59·5
23	10 43 26·3	14 46 (15·16)	39 27 1·4
	11 16 56·2	14 46 43·04	39 27 19·7
	11 37 21·4	14 46 44·82	39 27 19·1
	12 7 47·9	14 46 46·98	39 27 34·1

July 23. Something wrong in the first observation of R.A.

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Day. 1861.	Greenwich M.T.	Apparent R.A.	Apparent N.P.D.
	h m s	h m s	° ′ ″
July 26	10 13 5·7	14 51 50·00	40 26 14·0
Aug. 1	10 3 43·2	15 0 7·24	42 1 52·4
	10 27 56·9	15 0 7·79	42 1 55·1
	10 44 43·1	15 0 9·40	42 1 55·8
	11 11 31·6	15 0 10·00	42 2 5·3
2	9 40 17·7	15 1 27·09	42 14 43·3
	10 13 40·3	15 1 25·41	42 14 47·8
6	11 3 26·2	15 6 0·50	43 4 3·9
	11 21 32·1	15 6 0·39	43 4 21·1
	11 38 2·0	15 6 1·70	43 4 38·0
	11 53 53·0	15 6 2·55	43 5 2·9
8	11 9 44·2	15 8 14·14	43 26 16·3
	11 31 37·9	15 8 15·83	43 26 13·0
	11 47 20·9	15 8 16·60	43 26 25·4
15	10 55 9·2	15 15 45·79	44 32 44·2
	11 8 42·2	15 15 45·04	43 32 50·0
	11 22 16·8	15 15 47·56	44 32 28·4
16	8 41 9·1	15 16 45·72	44 40 1·4
	8 54 2·8	15 16 46·22	44 40 16·8
	10 6 21·4	15 16 49·40	44 40 29·2
	10 32 28·7	15 16 49·52	44 40 44·6
	10 49 21·9	15 16 50·29	44 40 29·2
19	8 43 2·5	15 19 58·65	45 3 59·6
	9 30 1·7	15 20 0·79	45 4 26·8
	9 43 22·6	15 20 0·96	45 4 29·5
	9 58 29·4	15 20 1·19	45 4 34·8
20	8 35 53·7	15 21 2·46	45 11 45·2
	8 57 18·5	15 21 3·49	45 11 58·8
	9 13 57·0	15 21 3·73	45 11 55·6
	9 48 24·4	15 21 5·75	45 12 6·1
	10 5 56·5	15 21 6·87	45 12 18·4
23	8 48 29·1	15 24 18·35	45 33 24·8
	9 23 49·1	15 24 20·49	45 33 36·9
	9 49 13·5	15 24 20·89	45 33 42·1
	10 1 45·2	15 24 21·31	45 33 44·7
	10 29 47·4	15 24 23·90	45 34 0·0
26	9 28 16·1	15 27 40·96	45 53 47·4
	9 52 15·2	15 27 41·82	45 53 47·7
	10 7 18·8	15 27 42·73	45 54 3·2
	10 16 30·0	15 27 43·56	45 54 10·0
27	8 16 20·7	15 28 43·86	45 59 48·6
	8 41 11·6	15 28 44·71	45 59 53·9
	8 55 45·7	15 28 45·73	45 59 55·9
	9 43 22·5	15 28 48·51	46 0 8·1

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Day.	Greenwich M.T.	Apparent R.A.	Apparent N.P.D.
1861.	h m s	h m s	° ′ ″
Aug. 27	10 25 55·5	15 28 49·45	46 0 25·7
30	9 15 48·9	15 32 10·80	46 18 22·6
	9 50 49·0	15 32 10·25	46 17 56·3
	10 36 9·5	15 32 15·05	46 17 37·0
Sept. 3	8 15 56·4	15 36 45·81	46 40 20·8
	8 31 56·7	15 36 46·66	46 40 33·7
	9 16 45·7	15 36 49·56	46 40 42·1
	9 36 50·4	15 36 47·67	46 40 44·5
	10 1 3·9	15 36 51·25	46 40 55·3
6	8 32 12·2	15 40 20·60	46 55 41·6
	8 54 41·5	15 40 20·76	46 56 0·9
	9 5 53·6	15 40 22·74	46 55 53·8
	10 2 13·2	15 40 25·27	46 56 11·2
10	8 50 0·4	15 45 13·54	47 14 15·9
	9 10 8·7	15 45 13·66	47 14 28·0
	9 23 45·9	15 45 14·78	47 14 15·2
	9 42 52·8	15 45 15·70	47 14 26·0
12	8 32 28·1	15 47 39·65	47 22 52·6
	9 0 54·2	15 47 42·12	47 22 49·1
	9 20 50·2	15 47 43·15	47 22 49·7
	9 38 57·9	15 47 43·78	47 22 55·3
14	7 53 48·9	15 50 9·91	47 30 31·6
	8 12 44·6	15 50 9·01	47 30 18·5
	8 34 43·2	15 50 12·10	47 30 28·7
	9 13 14·7	15 50 14·21	47 30 42·5
	9 26 59·5	15 50 15·75	47 30 45·9
17	9 14 5·8	15 54 2·74	47 41 37·5

Of the preceding observations, those to July 16 inclusive were made by myself, and the remainder were made by Mr. Quirling. A wire micrometer, furnished with a single fixed transit-wire and with a declination wire moveable by the screw, was used till the faintness of the comet made it necessary to observe in a dark field over thicker wires, when a negative eye-piece with metallic cross was substituted. This change occurred on Aug. 16. But, in all cases, the declination wire was used in a fixed position, and the reading of one microscope of the hour-circle and of one microscope of the declination-circle was taken for each observation of the comet and the stars of comparison. These stars were generally taken from the Radcliffe Catalogue, and were in general so near to the comet on the night of observation that the differential effect of instrumental errors will be insignificant. On July 15 and 16 the transits of the star and comet were made with an unchanged position of the polar axis, though the circles were read as on other evenings, and the results for these evenings are

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obtained by application of the index corrections obtained on other evenings.

All the observations are corrected for the effects of refraction and parallax.

The following is a list of the stars of comparison, together with the places assumed in the reduction of the observations.

Mean Places for 1861, *Jan.* 1, *of Stars compared with the Great Comet of* 1861.

Day of Comp.	Name.	Mean R.A.	Mean N.P.D.	Authority.
1861.		h m s	° ′ ″	
June 30	Capella	5 6 25·55	44 8 53·1	Nautical Almanac.
July 2	*o* Urs. Maj.	8 18 41·06	28 49 17·5	Radcliffe Catalogue.
3	*h* Urs. Maj.	9 20 31·72	26 20 0·7	,, ,,
4	*α* Urs. Maj.	10 55 7·25	27 29 58·7	Nautical Almanac.
5	,, ,,	,, ,,	,, ,,	,, ,,
,,	*γ* Urs. Maj.	11 46 30·19	35 31 57·0	,, ,,
6	76 Urs. Maj.	12 35 28·81	26 31 24·6	Radcliffe Catalogue.
8	83 Urs. Maj.	13 35 27·54	34 36 50·3	,, ,,
9	81 Urs. Maj.	13 28 46·58	33 56 17·7	,, ,,
10	84 Urs. Maj.	13 41 24·15	34 52 19·1	,, ,,
14	*	14 23 49·0	34 38 0·0	
15	*	,, ,,	,, ,,	
16	*	14 27 40·0	36 2 0·0	
,,	B.A.C. 4826	14 28 57·27	36 29 21·0	Radcliffe Catalogue.
23	B.A.C. 4937	14 51 46·18	39 48 7·4	,, ,,
26	,, ,,	,, ,,	,, ,,	,, ,,
Aug. 1	44 Boötis (2^{d})	14 59 12·46	41 48 11·3	,, ,,
2	,, ,,	,, ,,	,, ,,	,, ,,
6	,, ,,	,, ,,	,, ,,	,, ,,
8	Rümker 5030	15 13 32·37	43 52 19·7	Rümker's Cat.
15	Oeltz. Arg. 15347	15 19 24·07	44 14 8·1	Oeltzen-Argel. Cat.
16	Rümker 5050	15 15 53·52	45 3 32·0	Rümker's Cat.
19	Radcliffe 3387	15 21 13·65	45 12 35·4	Radcliffe Catalogue
20	,, ,,	,, ,,	,, ,,	,, ,,
23	Radcliffe 3387	15 21 38·49	45 30 23·4	,, ,,
26	B.A.C. 5175	15 33 40·19	45 56 28·0	,, ,,
27	,, ,,	,, ,,	,, ,,	,, ,,
29	,, ,,	,, ,,	,, ,,	,, ,,
30	,, ,,	,, ,,	,, ,,	,, ,,
Sept. 3	,, ,,	,, ,,	,, ,,	,, ,,
6	Radcliffe 3448	15 41 28·95	47 5 56·0	,, ,,
10	*ψ* Herculis	15 47 52·16	47 9 27·7	,, ,,
12	,, ,,	,, ,,	,, ,,	,, ,,
14	4 Herculis	15 50 50·05	47 1 39·65	,, ,,
17	,, ,,	,, ,,	,, ,,	,, ,,

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On June 30 the comet was also observed on the meridian with the transit-instrument and the meridian-circle, and the following is the result of the observation:—

1861, June 30	12^h 11^m 5^s·9	Greenwich Mean Solar Time.
	Apparent R.A.	6^h 42^m 10^s·89
	Apparent N.P.D.	42° 56′ 56″·1

the N.P.D. being corrected for refraction and parallax.

The following are the notes which I made on the appearance of the comet:—

1861, June 30. This splendid comet burst suddenly on the view this evening. I saw it first at about 10 o'clock, and immediately prepared to observe it. Its appearance, notwithstanding the strong daylight, was most brilliant. To the naked eye the condensation of light about the head was so great as to bear comparison with the Moon rather than with any other object. In fact the diameter of the coma was about 30′ by measurement at some Observatories on this evening. The tail streamed vertically upwards, and near midnight could be traced considerably beyond *Polaris*, which it passed over. Its length on this evening has been variously estimated from 100° to 120° by the most careful observers.

In the telescope of the heliometer there appeared a nucleus of an elliptical shape, with its major axis a little inclined to the vertical, that is, directed nearly towards the Sun. It was about the size of the ball of *Saturn*, near opposition, or about 20″ in diameter. A stream of light went off from the upper apparent part of the nucleus, and turned round towards the apparent west in the shape of a sickle. Another but fainter stream was seen on the apparent east side of the first stream, also turning round towards the west.

July 2. In appearance not very different from that on June 30. A sickle-shaped stream of light setting out westward (apparently), and seeming for a little distance parallel to the declination wire, and then turning rapidly downwards (that is, away from the Sun). The nucleus elliptical as before, with its major axis inclined at an angle of 15° to the declination wire. The second stream of light was visible, but not so well defined as before. Clouds rendered physical observations difficult. The tail at least 70° in length.

July 3. The evening was too cloudy for accurate physical observations, but it appeared as if the formations round the nucleus were becoming more regular and concentric, and more like Donati's comet. At midnight the clouds cleared away, and the view of the comet with the naked eye was magnificent. The tail was about 60° in length, being visible beyond the zenith.

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July 4. The comet is rapidly becoming fainter. The tail could not be traced farther than 40° from the nucleus, but the brilliancy of the nucleus is still very great. In the telescope the nucleus appeared pear-shaped, with the point (apparently westward) and the axis parallel to the declination axis. Two curved streams of light are still seen flowing from it, the lower one sickle-shaped, but not so well defined as previously, cutting the declination wire at an angle of about 60°; the upper arc ill defined and cutting the declination wire at an angle of 30°. The whole formed the sector of a circle of about 100°.

July 5. I examined the head of the comet to-night with a lower power. The nucleus is now very bright, and almost equal to a star of the first magnitude (I compared with α *Ursæ Majoris* in the twilight). It is of the same shape as on the preceding night. The head of the comet is altogether like a fan expanded to about 120°. Round the nucleus is a very bright circle of light, scarcely separable from it, and the two diverging streams of light now pass symmetrically on each side of the nucleus.

July 9. The shape of the head is that of an expanded fan. The nucleus terminates in a bright stellar point towards the apparent east, and is very narrow and pear-shaped, running parallel to the declination wire (or to the equator). Round the nucleus is a bright envelope of a circular shape, and, beyond that, another very faint and diffused. The distinctness of the envelope is not at all comparable with Donati's comet of 1858. The whole of the field is very strongly illuminated with the light of the comet.

July 10. The appearance of the comet has not materially changed since last night, except that the shape of the nucleus is materially different, having become more obtuse.

By my directions, Mr. Quirling confined himself for several evenings after the first appearance of the comet to observations of the length, breadth, and peculiarities of the tail, and incorporated the results of his observations in a series of drawings, in which the position and magnitude of the tail are defined accurately by means of the stars which it passed over or near to. The following is an abstract of his observations:—

"July 4. This was the first favourable evening after June 30 for observations of the tail. At $10^h 40^m$ the head of the comet was nearly in a line with α and β *Ursæ Majoris*, and the northern boundary of the tail passed just over α *Draconis*, and could be traced a short distance beyond that star. The estimated length was about 25°. The shape near the head was that of a very flat parabola, and the northern boundary was by far the brighter one.

"At $11^h 30^m$, the darkness being greater, the comet had increased considerably in apparent brightness. The northern border of the tail passed beyond α and ι *Draconis*, which were seen through it; it passed exactly over ι *Draconis*, and could

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be traced towards τ *Herculis.* The southern border was far less distinct; it passed north of δ *Draconis*, of several stars of the 6th magnitude. Estimated length, about 44°.

"At $12^{\rm h}$, the northern border could be traced beyond η *Herculis;* the southern border still less distinct than the northern. In the vicinity of δ *Draconis* there seemed to be faint traces of a second tail. Whole length of tail, 60° to 65°; breadth, 7° to 8°.

"July 5, $11^{\rm h}\,30^{\rm m}$. Sky very fine. The tail could be traced nearly to τ *Herculis,* the northern boundary being still the better defined. The southern border scarcely reached δ *Draconis,* and passed over ι and κ *Böotis,* where there was again the faint beginning of a second tail, bending northwards, as on the night before. The tail did not reach τ *Herculis.* Length, about 45°; greatest breadth, 10°.

"July 8, $11^{\rm h}\,30^{\rm m}$. The evening in general not favourable. The comet considerably fainter than on July 5, but still a conspicuous object in the heavens. The centre of the tail pointed midway between ϱ and χ *Herculis;* but it could not be traced up to those stars. The fan or second tail, which was observed on July 4 and 5, had entirely disappeared. Length, about 27°.

"July 9. General appearance nearly the same as on the preceding night. Length, about 20° to 24°.

"July 14. The comet considerably smaller. The head, which had been up to this time always estimated as of the 1st and 2d magnitude, was to-night decidedly not brighter than a star of the 3d magnitude. Both borders of the tail well defined, though the northern could be traced farther than the southern. Length of tail, 15° or 16°.

"July 16. The appearance very similar to that on July 14. Length, 12° or 13°."

Progress of the Charts in course of execution at Bonn. Communicated by Mr. Carrington, as received from Dr. Krüger, by the direction of Dr. Argelander.

Seven sections, each comprising four sheets, are published. The first four sections were received several months since by the Observatories and Astronomers to whom they are presented. Sections 5, 6, and 7 were despatched, through Marcus of Bonn, at the end of last October; and vols. iii. and iv. of the *Bonn Observations,* being vols. i. and ii. of the present *Survey,* are about to follow. The charts comprising the Zone 2° S. to 20° N., and the next, 20° N. to 40° N., are fully published; and section 7, containing sheets 26, 27, 32, 33, will amount to half the next Zone, 40° to 60° N.